

PICL-4: Second Creek approx 1 mi upstream of CR 14 bridge (Lauderdale Co 34.92624/-88.04680)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) began monitoring lake water quality statewide in 1985, followed by a second statewide survey in 1989. In 1990, the Reservoir Water Quality Monitoring Program [now known as the Rivers and Reservoirs Monitoring Program (RRMP)] was initiated by ADEM.

The current objectives of this program are to provide data that can be used to assess current water quality conditions, identify trends in water quality conditions and to develop Total Maximum Daily Loads (TMDLs) and water quality criteria. Descriptions of all RRMP monitoring activities are available in ADEM's 2012 Monitoring Strategy (ADEM 2012).

In 2015, ADEM monitored the Second Creek tributary embayment of Pickwick Reservoir as part of the basin assessment of the Tennessee River under the RRMP. This site was selected using historical data and previous assessments. The purpose of this report is to summarize data collected in the Second Creek embayment (PICL-4) during the 2015 growing season (Apr-Oct). This is the fourth basin assessment of the Tennessee River since ADEM began sampling tributary embayments. Monthly and/or mean concentrations of algal biomass/productivity [chlorophyll *a* (chl *a*); algal growth potential testing (AGPT)], sediment [total suspended solids (TSS)], and trophic state [Carlson's trophic state index (TSI)] from 2015 were compared to ADEM's previous data and established criteria.

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Second Creek is classified as a *Public Water Supply/Swimming/Fish & Wildlife (PWS/S/F&W)* stream located in the Transition Hills ecoregion (65j). Based on the 2006 National Land Cover Dataset, land use within the 73 mi² watershed is predominantly forest (70%) (Fig. 3). As of January 28, 2016, ADEM has issued a total of one NPDES permit within the watershed. This permit is not located within 10 mi of the station (Fig. 2).

SITE DESCRIPTION

The Second Creek embayment at PICL-4 is a fairly wide embayment surrounded by residential houses to the west and a park to the east, located near the community of Waterloo, AL. The embayment has a mean bottom depth of 4.7 m (Table 2) at the sampling location and flows into the main channel near Tennessee River mile 227.



Figure 1. Photo of Second Creek at PICL-4

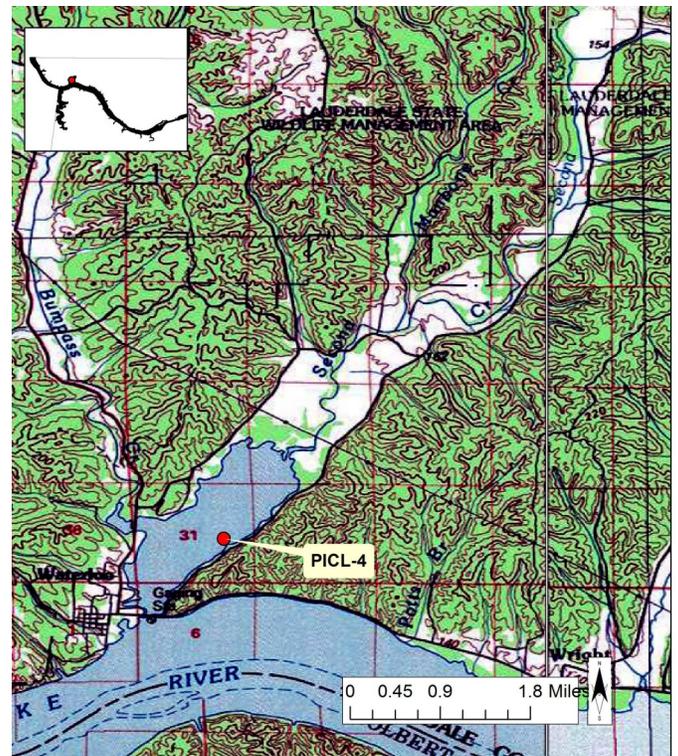


Figure 2. Map of Second Creek Embayment of Pickwick Reservoir. Though additional permitted facilities may occur in the watershed (Table 1), only those discharges within 10 miles upstream of the station are displayed on the map.

METHODS

Water quality assessments were conducted at monthly intervals, April-October. All samples were collected, preserved, stored, and transported according to procedures in the ADEM Field Operations Division Standard Operating Procedures (ADEM 2015), Surface Water Quality Assurance Project Plan (ADEM 2012), and Quality Management Plan (ADEM 2013).

Mean growing season chl *a*, TSI, and TSS were calculated to evaluate water quality conditions. Monthly concentrations of these parameters were graphed with ADEM's previously collected data to help interpret the 2015 results. Carlson's TSI was calculated from the corrected chl *a* concentrations.

RESULTS

The following discussion of results is limited to those parameters which directly affect trophic status or parameters which have established criteria. Results of all water chemistry analyses are presented in Table 2. The axis ranges of the graphs in Figs. 4-5 were set to maximum values reservoir-wide so all embayment reports on the same reservoir could be compared.

Table 1: Summary of Watershed PICL-4

Basin	Tennessee R
Drainage Area (mi ²)	73
Ecoregion ^a	65j
% Land use	
Open Water	2%
Developed	Open Space
	Low Intensity
	Medium Intensity
	High Intensity
Barren Land	<1%
Forest	Deciduous Forest
	Evergreen Forest
	Mixed Forest
Shrub/Scrub	12%
Herbaceous	4%
Hay/Pasture	6%
Cultivated Crops	2%
Wetlands	Woody
	Emergent Herb.
#NPDES Permits ^b	TOTAL
Construction Stormwater	0
Mining	0
Small Mining	0
Industrial General	0
Industrial Individual	0
No Exposure	0
Municipal	1
Underground Injection Control	0

a. Transition Hills

b. #NPDES outfalls downloaded from ADEM's NPDES Management System database, Jan 28, 2016.

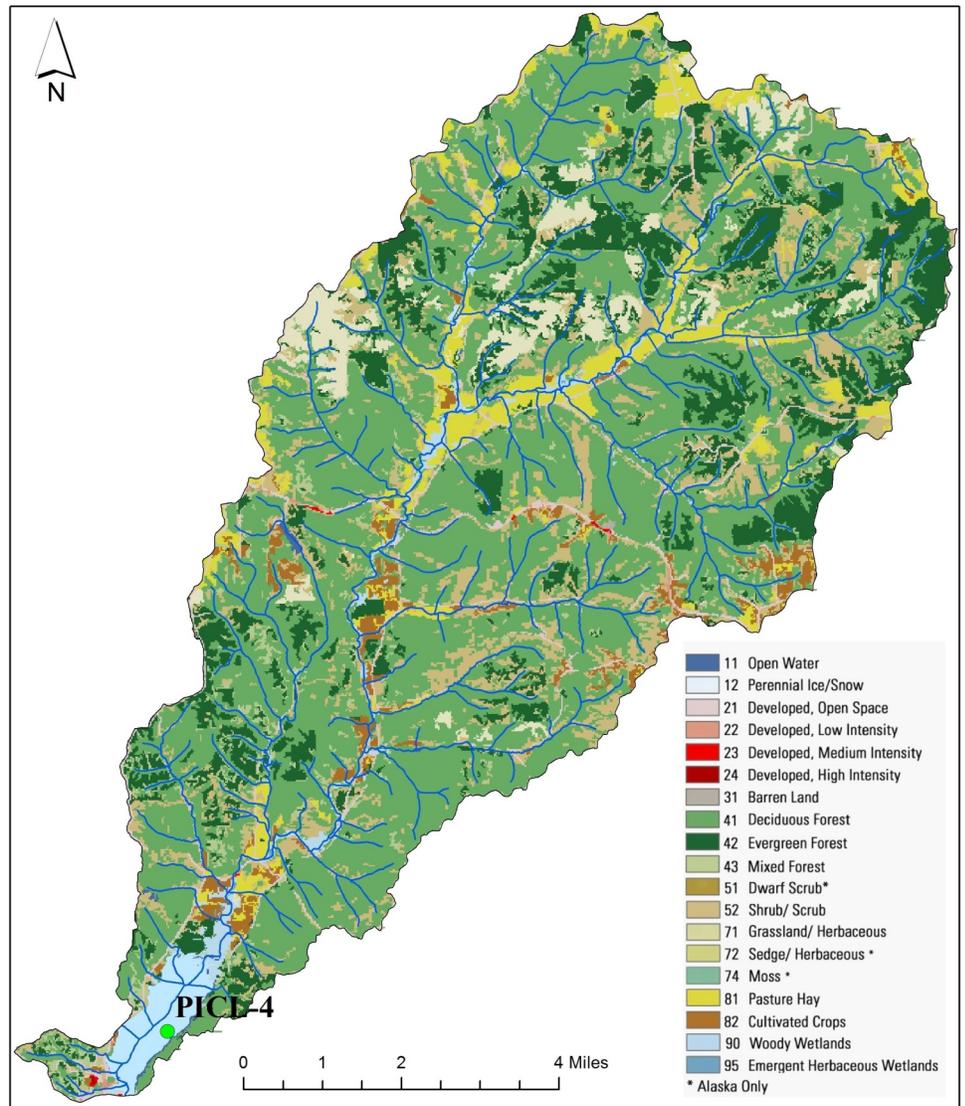


Figure 3. Land use within the Second Creek watershed at PICL-4.

The mean growing season TN value was higher in 2015 than in any prior year (Fig. 4). Monthly TN concentrations were highest in August.

Mean growing season TP concentration was lower in 2015 compared to any previous sampling years (Fig. 4). The highest monthly TP concentration was reached in October.

In 2015, the growing season mean chl *a* value was less than 2013 and has decreased since 2003 (Fig. 4). Monthly chl *a* concentrations generally increased May-October with a peak in October.

Mean TSI was eutrophic in 2015 and similar in value to previous sample years. Monthly TSI in Second Creek was oligotrophic May-June and eutrophic July-October (Fig. 4).

The mean growing season TSS value was higher in 2015 than 2013 (Fig. 4). Monthly TSS concentration was highest in July.

The DO concentration in the PICL-4 station was well above the ADEM criteria limit of 5.0 mg/l at 5.0 ft (1.5 m) in all months (ADEM Admin. Code R. 335-6-10-.09) (Fig. 5).

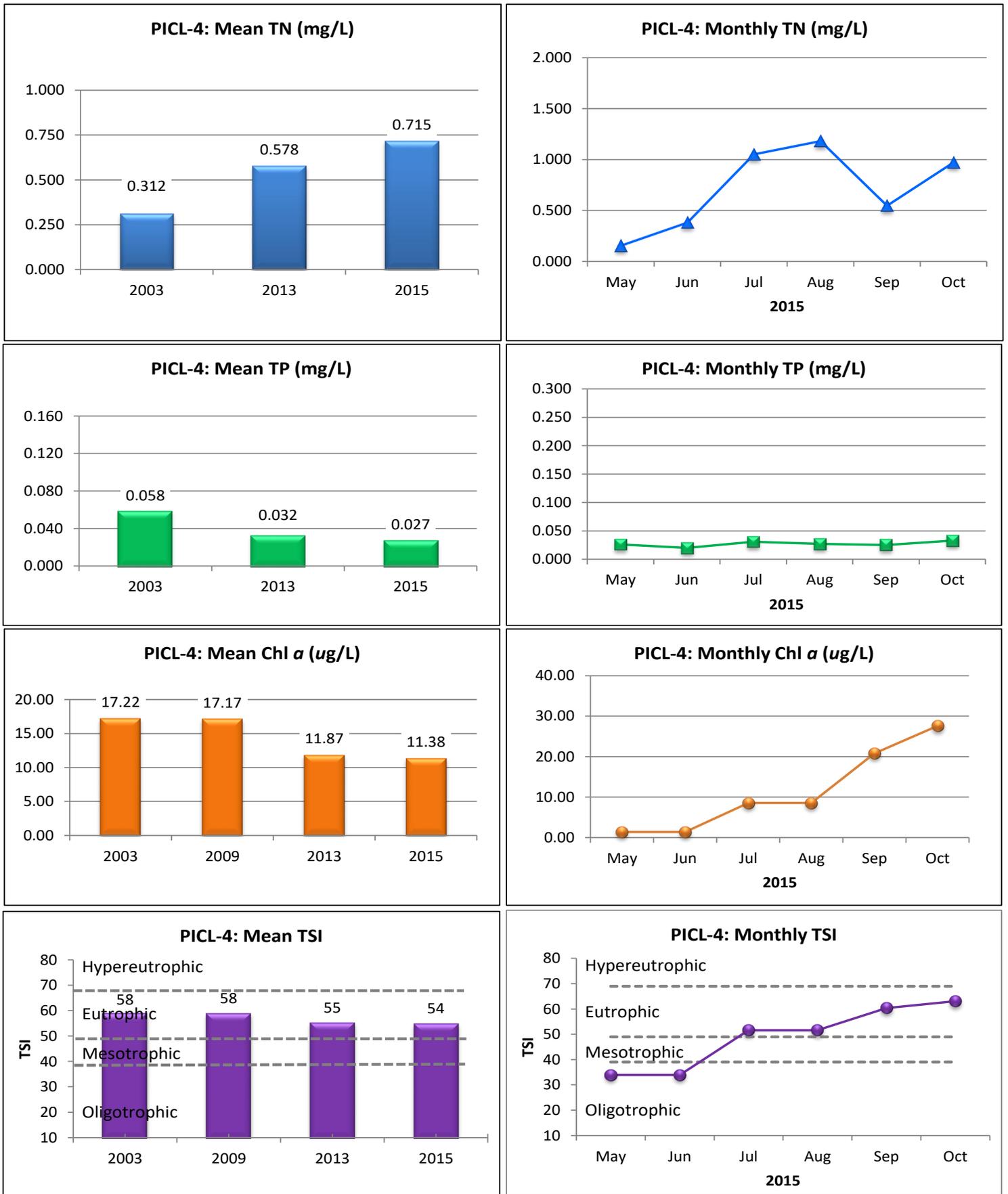


Figure 4. Mean growing season (2003-2015) and monthly (April-October, 2015) chl *a*, TSI, and TSS measured in the Second Creek embayment of Pickwick Reservoir. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir. 2009 mean TN and mean TP data did not meet ADEM QA standards and are not included.

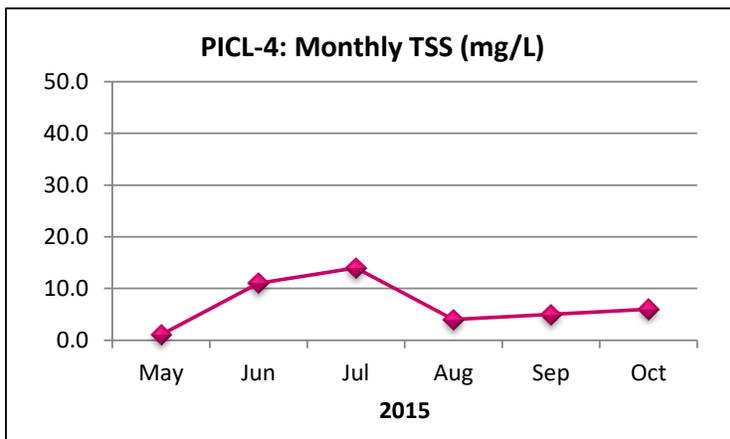
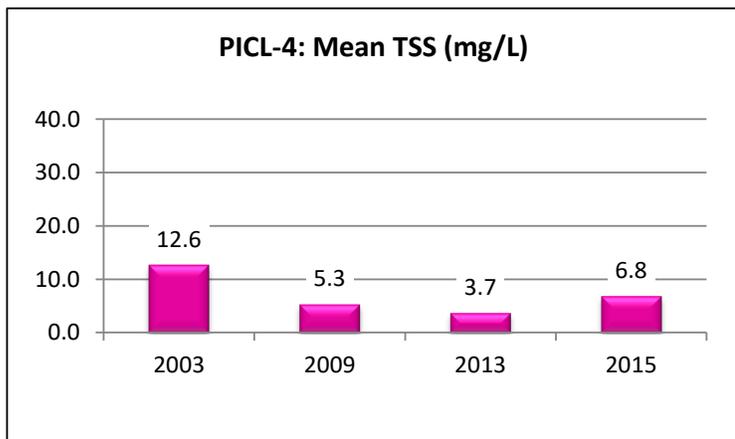


Figure 5. Mean growing season and monthly TSS measured in the Second Creek embayment of Pickwick Reservoir.

Table 2. Summary of water quality data collected April-October, 2015. Minimum (Min) and maximum (Max) values calculated using minimum detection limits. Median (Med), Mean, and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

PICL-4	N	Min	Max	Med	Mean	SD
Physical						
Turbidity (NTU)	6	4.4	8.6	5.4	5.9	1.5
Total Dissolved Solids (mg/L)	6	78.0	97.0	88.0	88.3	7.8
Total Suspended Solids (mg/L)	6	1.0	14.0	5.5	6.8	4.8
Hardness (mg/L)	3	56.4	71.8	58.9	62.4	8.3
Alkalinity (mg/L)	6	52.0	65.8	57.5	58.0	4.6
Photic Zone (m)	6	4.16	4.66	4.30	4.35	0.19
Secchi (m)	6	1.06	1.50	1.24	1.27	0.20
Bottom Depth (m)	6	4.3	5.1	4.8	4.7	0.3
Chemical						
Ammonia Nitrogen (mg/L)	6	< 0.010	0.181	0.005	0.049	0.074
Nitrate+Nitrite Nitrogen (mg/L) ^J	6	< 0.002	0.004	0.002	0.002	0.001
Total Kjeldahl Nitrogen (mg/L)	6	0.152	1.180	0.757	0.713	0.413
Total Nitrogen (mg/L) ^J	6	< 0.156	1.182	0.760	0.715	0.412
Dis Reactive Phosphorus (mg/L) ^J	6	< 0.003	0.009	0.003	0.004	0.002
Total Phosphorus (mg/L)	6	0.020	0.033	0.026	0.027	0.005
CBOD-5 (mg/L)	6	< 2.0	2.0	1.0	1.0	0.0
Chlorides (mg/L)	6	5.2	8.4	7.1	6.7	1.2
Biological						
Chlorophyll a (mg/m ³)	6	1.40	27.60	8.54	11.38	10.65
E. coli (MPN/DL) ^J	3	< 1	1	1	1	0

^J= one or more of the values is an estimate; N=# samples.

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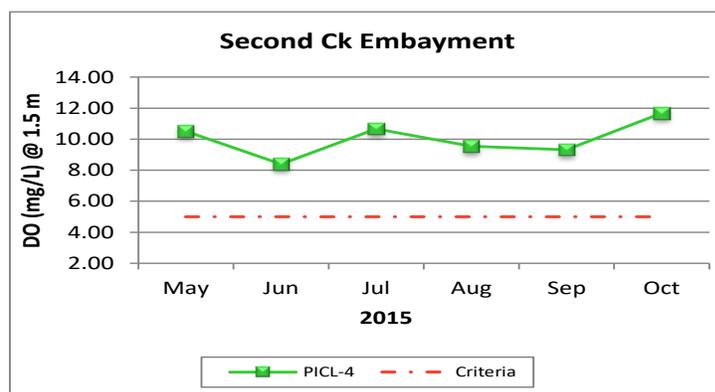


Figure 6. Monthly DO concentrations at 1.5 m (5 ft) for Second Creek embayment station of Pickwick Reservoir collected April-October 2015. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

REFERENCES

- ADEM. 2015. Standard Operating Procedures Series #2000, Alabama Department of Environmental Management (ADEM), Montgomery, AL.
- ADEM. 2013. Quality Management Plan (QMP) for the Alabama Department of Environmental, Alabama Department of Environmental Management (ADEM), Montgomery, AL. 58 pp.
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